

CLASSIFICATION:

Vegetable origin – cotton, jute, Hemp, flax

Animal origin – wool, silk

Mineral origin – asbestos, glass wool

Synthetic origin – nylon,

Regenerated from cellulose – rayon

BY NOORUDDIN KHAN

- **COTTON / RAW COTTON**

- **BIOLOGICAL SOURCE:** trichomes of seeds of cultivated species of gossypium herbaceum

Family: malvaceae

GEOGRAPHICAL SOURCE: India, Egypt

- **Collection:**

The capsule of cotton consists contains large number of seeds covered with trichomes

The trichomes are separated

Long trichomes are used in preparation of fabric & short ones are used in preparation of surgical dressings

This non absorbent cotton when treated with dilute soda solution for 10 to 15 hours at a higher pressure gets free of fats

The resulting absorbent cotton is dried, sterilized with gamma radiation

- **Description:**
White, soft to touch
- **Chemical Tests:**
ABSORBENT COTTON:
 - Fibre when treated with N/50 iodine solution & 80% H₂SO₄ gives a blue stain
 - Fibre when treated with cuoxam reagent, swells & dissolves
 - Fibre gives a blue stain with chlorzinc iodide
- **NON ABSORBENT COTTON:**
 - Fibre when treated with cuoxam reagent, swells & dissolves with ballooning
 - Fibre gives a violet stain with chlorzinc iodide
- **Uses:**
Fabrics, surgical dressings

1. Cotton



- **Syn:** raw cotton, purified cotton, absorbent cotton, surgical cotton
- **Source:** epidermal trichomes or hairs of the seeds of the cultivated species of the *Gossypium* species like ***Gossypium herbaaccurrc*, *Gossypium barbadense***
- **Family: Malvaceae**
- Purified or absorbent cotton: consists of trichomes but freed from fatty matter and adhering impurities, bleached & sterilized
- **GS:** Commercially in India, US, Egypt
- **Constituents:** raw cotton: 90% cellulose & 7-8% moisture, wax, fat and remains of protoplasm
- While purified-absorbent cotton-entirely cellulose with 6-7% moisture

○ Method of preparation:

- *Plant after flowering, bears fruits known as capsule, fruits are 3-5 celled*
- *Each capsule contain numerous seeds*
- *Seeds covered with the hairs are known as bolls.*
- *The bolls are collected, dried and then taken to ginning press, wherein trichome are separated from seeds,*
- *Various devices are used to separate the hairs.*
- *The short & long hairs are separated from each other.*
- *The hairs with short length are known as linters and are used for the manufacture of the absorbent cotton.*

- Long hairs are used for preparation of cloth.
- The raw cotton is obtained by this way is full of impurities like wax, fat, coloring matter, vegetable debris etc
- It is processed to get rid of most of the impurities.
- It is taken to the machine known as cotton opener and followed by treatment with dilute soda ash solution under pressure for about 10-15 hours.
- The wax, fatty material and coloring matter are removed by this treatment.
- It is then washed with water and treated with suitable bleaching agent.
- It is again washed with water, dried and carded into flat sheets.
- Finally packed in wrappers and sterilized by means of gamma radiations.

○ **Description:**

- Color: white due to bleaching, slightly off white if sterilized
- Taste: tasteless
- Size: 2.5-4.5 cm l length and 25-35 micron in diameter
- Free from pieces of leaves, seed coat, foreign matter and dust.

○ **Chemical Test:**

1. Soak cotton fibre in iodine water & dry → add few ml of 80% H_2SO_4 , trichome assume purplish-blue or bluish-green color
2. Ammonical copper oxide solution (cuoxam reagent) dissolves raw cotton fibres with the formation of balloons, while absorbent cotton dissolves completely with uniform swelling.
3. Cotton is insoluble in dilute sodium hydroxide solution and HCl (distinction from silk)
4. Cotton is soluble in 55% H_2SO_4



- **Uses:**

- *Filtering medium*

- *Surgical dressing*

- *Insulating material*

- *Absorbent cotton: absorbs blood, mucus, pus and prevents the wound from infections.*

- **Storage:**

- *cool place*

- *Bacterial infection → makes cotton friable & brittle*

- *Should be wrapped in wrappers so as to prevent the dust and microbial contamination.*

- *Heat and long storage, makes absorbent cotton, less absorbent.*

JUTE

BIOLOGICAL SOURCE: obtained from phloem fibres of *Corchorus capsularis*

Family: Tiliaceae

Description:

Brown, rough to touch

Chemical Test:

Fibre when stained with phloroglucinol & HCl gives a deep red colour

Fibre gives a yellow stain with chlorzinc iodide

Uses:

Preparation of jute bags

2. Jute

- **Source:** fibres of the stem of various species of **Corchorus olitorius**, **C.capsularis**
- **Family:** Tiliaceae
- **GS:** West bengal where loamy soil with pH 6-8
- **Constituents:** 53% cellulose, 20% hemicellulose, and 10% lignin
- **Color:** Yellowish brown
- **Chemical Test:**
- Middle lamella is highly lignified and gives red color with phloroglucinol & conc. HCl
- **Uses:**
- Manufacture of stupa, padding splints, filtering & straining medium , manufacture of coarse gunny bags



SILK

BIOLOGICAL SOURCE: obtained from secretion / cocoon of bombyx mori

Family: bombycidae

Description:

Yellow, smooth to touch

Uses:

Sutures & ligatures

Collection:

The larvae produces fibroin from the mouth glands which gets united with a gum like secretion known as sericin to form a cocoon

These cocoons are exposed to steam & finally plunged in boiling water to separate the gum & the fibres

Chemical:

Proteins & sub units made of alanine & glycine

Chemical Tests:

Fibre does not blacken on treatment with lead acetate

On treatment with millon's reagent it gives a brick red colour

3. Silk

- **Source:** fibres obtained from cocoons of *Bombyx mori* (mulberry silkworm)
- **Family:** Bombycidae, **Order:** Lepidoptera
- **GS:** Japan, Italy, China, France, India
- **Constituents:** protein known as fibroin, fibroin → on hydrolysis → amino acid glycine + alanine
- **Color:** usually Yellowish threads
- **Chemical Test:**
- Since it does not contain, sulfur, test with lead acetate is negative.
- Insoluble in water and alcohol
- Soluble in cuprammonium solution, 66% H₂SO₄, Conc. HCl
- **Uses:** special types of sutures, sieves and ligatures

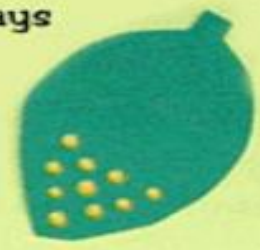


○ **Method of preparation:**

- *The larvae of the silkworm produce silk fibroin fibres from the glands in their mouth*
- *This fibroin gets united with a gum like secretion known as sericin and forms cocoon*
- *These cocoons are not allowed to grow further into an insect, but are heated to 60-80 degree C by exposing them to steam.*
- *The exposed cocoons are put into hot water to dissolve the gum and to separate fibres*



The female moth lays many tiny eggs.



EGG

A tiny black caterpillar hatches out of its egg.



The caterpillar eats mulberry leaves and grows bigger and bigger. It goes through 4 molts.



LARVA

The caterpillar spins a cocoon of silk threads around itself.



PUPA

Inside the cocoon, the caterpillar changes into a pupa.



ADULT

The pupa changes into a moth. The moth comes out of the cocoon.



The adult moths mate with each other.

SILKWORM LIFE CYCLE



People unwind the silk thread from the cocoons to weave into silk cloth.

WOOL

BIOLOGICAL SOURCE: obtained from fleece of sheep ovis aries

Family: bovidae

Description:

Soft, lustrous

Preparation:

Raw wool is washed with water followed by a second washing with soap solution & then treated with sulphuric acid

The wool fat is separated by extracting with acetone

Thus wool fibre is obtained

Chemical Test:

Fibre blackens with lead acetate

Uses:

Fabrication, ligatures & sutures

4. Wool

- **Source:** fibres obtained from fleece sheep **Ovis aries**
- **Family: Bovidae, Order: Ungulata**
- **GS:** Australia, Russia, Argentina, US and India
- **Constituents:** sulphur containing protein known as keratin, rich in amino acid cystine.
- **Chemical Test:**
- When lead acetate is added to a solution wool in NaOH, black ppt is formed due to high sulphur content.
- Insoluble in copper solution, 66% H₂SO₄, Conc. HCl
- **Uses:** filtering & straining medium, manufacture of dressing like domette and crepe bandages and flannel.



GLASS WOOL

Source: made up of silica, mixture of silica & oxides of aluminium, calcium, boron & magnesium

Uses:

Insulating material & in manufacture of filters

Chemical Tests:

Fibre is partly soluble in 60% sulphuric acid

Fibre on ignition forms a hard bead

7. Glass fibre



- *The fibres consists of sand (silica),*
- *mixed with oxides of aluminium, calcium, boron and magnesium.*
- *They are unaffected by all usual reagents used in identification of fibres.*
- *They melt at high temperature and form a transparent bead.*
- *They are used in filter fabrics for insulation and splinting material.*

- **Method of preparation:**

- *The hairs forming on the fleece of the sheep are removed at shearing time.*
- *They are then processed to remove the wool fat and dirt.*
- *The clean & de-fatted wool is subjected to bleaching, washed again and dried.*
- *When observed under high power, wool shows cuticle, cortex and medulla.*



RAYON / VISCOUS RAYON / REGENERATED CELLULOSE

Preparation:

Cellulose is treated with sodium hydroxide to yield sodium cellulosate

This when treated with carbon disulphide in sodium hydroxide gives sodium cellulose xanthate

The solution is passed through fine nozzles in a bath of sodium sulphate & H_2SO_4 to yield filaments of viscous rayon

It is further made free of sulphur, bleached & washed

Uses:

Preparation of surgical dressings & fabric

5. Rayon



- **Syn:** Regenerated cellulose, Viscose rayon
- **Source:** artificial fibres composed of regenerated cellulose in which substituents have replaced hydrogen of $-OH$ group. Now, it is exclusively prepared by the viscose process.
- **Preparation:**
- The cellulose of coniferous wood in the form of pulp is processed to give viscose rayon.
- The pulp contains 80-90% of cellulose and hemicellulose.
- The cellulose is treated with $NaOH$ to get Sodium cellulose.
- It is further treated with CS_2 & $NaOH$ to produce viscose solution of sodium cellulose xanthate.
- After ripening, this solution is forced through the fine nozzles into the bath of sodium sulphate and H_2SO_4 to give continuous filaments.
- The filaments are drawn together to form the yarn.
- The yarn is desulphurized, bleached, washed, twisted and then dried.
- Rayon contains about 10% moisture and does not lose absorbency on storage like cotton.
- **Uses:**
- Making fabrics, preparation of surgical dressing, viscose rayon & absorbent wool.

6. Nylon



- **Syn:**
- *It is the polymer of adipic acid and hexamethylene diamine.*
- *The fibres are highly lustrous to dull, white or colored.*
- *When applied to flame, the fibre melts with formation of bead.*
- *It is soluble in 5M HCl and insoluble in acetone.*
- *It is soluble in 90% formic acid & phenol (90%) which distinguishes it from fibres of biological origin.*
- **Uses:**
- *Filter clothes, sieves and non-absorbable sutures.*

8. Asbestos

- Contains mainly hydrated magnesium silicates.
- Rock asbestos is white, yellow or green in color.
- It is highly refractive and also do not fuse when heated.
- **Chemical Test**
- Insoluble in warm HCl
- **Uses:**
- Preparation of filtering medium & for bacterial filters.

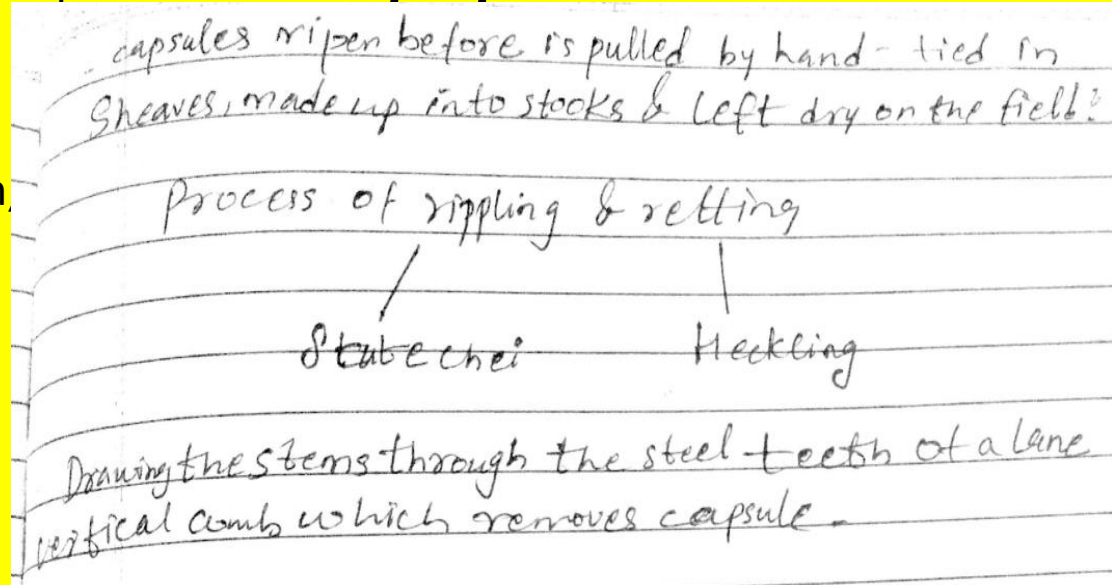


Linseed (flax seed)

- **Biological Source** It consists of the dried fully ripe seeds of *Linum usitatissimum* Linn. Belonging to family Linaceae.
- **Geographical Sources** Algeria, Egypt, Greece, Italy and Spain; as a source of oil in Afghanistan, India and Turkey; and in Russia (now CIS – countries) for both oil and fibre. It is also found in several temperate and tropical zones.

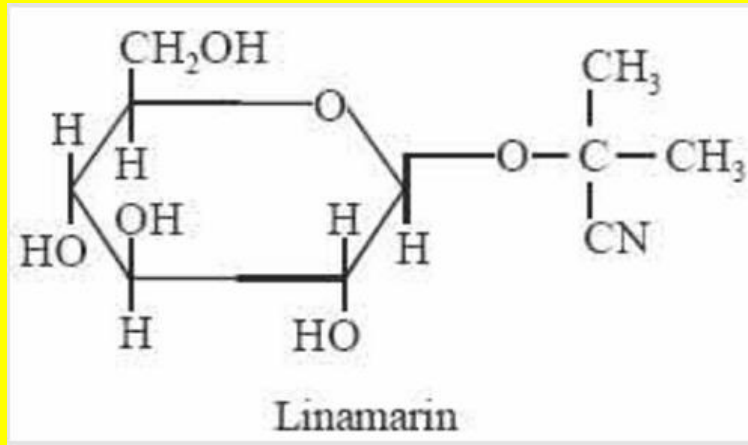
preparation

- **Description**
- Hygroscopic, good luster,
- tensile strength greater than cotton.
- Reddish brown, Characteristic odour
- ,Length = 4-6 mm; Width = 2-3 mm.



Linseed (flax seed)

- **Chemical Constituents** The ripe seeds of linseed contain small quantities of a cyanogenetic glycosides known as *linamarin* (or phaseolunatin) as given below:
- Interestingly, linamarin evolved HCN with linseed meal only but not with emulsin. However, pure linamarin is a bitter needle like crystalline substance. It is freely soluble in water, cold alcohol, hot acetone, slightly in hot ethyl acetate, ether, benzene, chloroform and practically insoluble in petroleum ether.
- Besides, linseed seeds comprise of fixed oil (33-43%) mucilage present in testa (6%), proteins (25%) and an enzyme called *linase*.
- **Linamarin** upon enzymatic hydrolysis yields HCN which actually renders the seeds highly poisonous.



Linseed (flax seed)

- **Chemical Test** 8% caustic soda solution & pressed under coverslip gives fibrillar structure (run spirally anticlockwise direction) pectocellulose
- Treatment with cuprammonium does not form spherical swelling
- Ordinary cellulose it differs towards certain colouring matter such as fuchsin, cyanine & Methylene blue
- **Uses**

+Therapeutically, the linseed oil is mostly recommended for the external applications only; **liniments and lotions.**

+**treatment of scabies and other skin disease in combination with pure flowers of sulphur.**

+ As the linseed oil has an inherent very high 'iodine value' it is used mostly in the preparation of non staining '**Iodine Ointment**' and several other products such as: '**Cresol with Soap**'.

+Commercially, it is one of the most important 'drying oil'; and, therefore, substantially huge amounts are exclusively used for **varnishes and paints.**

+**the manufacturer of soap, grease, polymer, plasticizer, polish and linoleum.**

HEMP (Cannabis)

Synonyms Indian Hemp; *Indian cannabis*; *Marihuana*; Marijuana; Pot; Grass; Weed; Bhang; *Ganja*; *Charas*, *Hashish*.

Biological Source Cannabis consists of the dried flowering tops of pistillate Annual plants of *Cannabis sativa* L., (*C. sativa* var. *indica* Auth.), **family**: Cannabinaceae.

Uses It has been used as a sedative in equine colic.

HEMP (Cannabis)

HEMP:

- consist of pericyclic fibres & is obtained from an annual plant *cannabis sativus* family: Cannabinaeae
- Hemp differs transverse sections where cavities of the cell appears relatively large, oval in shape end blunt.
- Fibre structure of hemp runs spirally in clockwise direction in 8% caustic soda.